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TWO HISTORIC WORLD-PESTILENCES ROBBED OF THEIR
TERRORS BY MODERN SANITATION

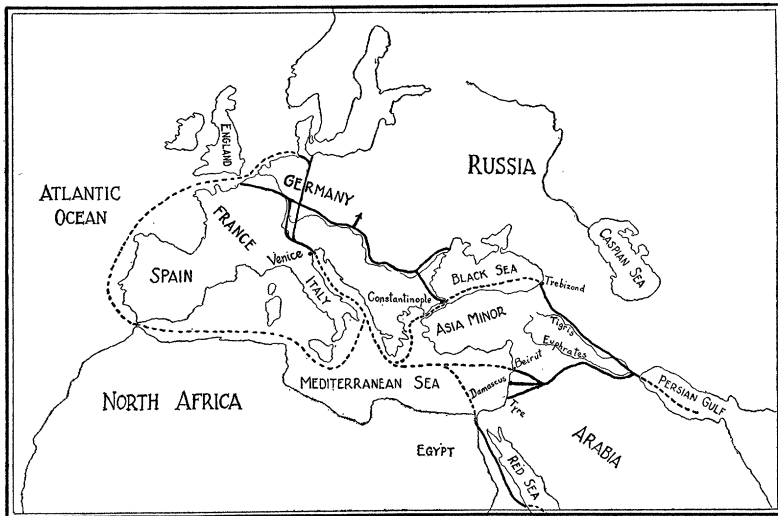
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THE presence of bubonic plague at New Orleans two years ago and the recent outbreaks of cholera which have followed upon the progress of the war in Austria are striking reminders of two of the most terrible pestilences which have ever scourged the human race. They are of special interest to the student of history and geography because in the past these two diseases furnished admirable examples of the manner in which infection travels along trade routes in the wake of commerce and migration. The security which civilized countries may enjoy against their attacks is a brilliant demonstration of the triumphs of modern sanitary science.

Bubonic plague, the Black Death of the Middle Ages, with which our National Health Service has successfully grappled at New Orleans, is one of the most virulent diseases known to sanitarians and if not immediately recognized and attacked would claim victims without number. From time immemorial we have records of the presence of this pestilence. The Levant and adjoining countries have been the centers of plague for at least 3,000 years, due to their unique positions as the gateway between the East and the West. Biblical reference to this disease as occurring among the Philistines is found in the Book of Samuel (I Samuel, Chaps. V. and VI.). The world has passed through two worldwide epidemics of plague in the past and we are now in the midst of a third.

The first authentic epidemic of plague originated at Pelusium in Egypt, in 542 A.D. At that time Pelusium was a leading center for trade between the East and the West. By means of travelers and merchants the disease spread slowly through Alexandria and the rest of Egypt, on the one hand, and, on the other, passed into Palestine and over the then known world, following closely the highways of commerce. In order to trace more clearly the connection between commerce and the spread of the plague, it is well to remember that the main routes between Europe and the East were along the Mediterranean Sea and overland through Turkey, Germany and France. It was along precisely these routes that plague traveled, as can be seen from the accompanying maps. At the height of the epidemic the number of dead reached 5,000 a day and during some days the mortality rose to 10,000. According to Procopius, a witness of this epidemic,



TRADE ROUTES DURING THE MIDDLE AGES

FIG. 1.

it spared neither island nor cave nor mountain top where man dwelt. . . . Many houses were left empty and it came to pass that many from want of relatives and servants lay unburied for several days. At that time it was hard to find any one at business in Byzantium. Most people who met in the streets were bearing a corpse. All business had ceased, all craftsmen deserted their crafts. . . .

The second great epidemic of plague, known in history as the Black Death, originated in Mesopotamia, an old endemic center of this disease, about the middle of the eleventh century. It is thought that the returning Crusaders during the twelfth and thirteenth centuries assisted in this recrudescence of plague. Again the disease followed the routes of travel and commerce, but this time going further north into Europe. During this epidemic some 25,000,000 people, or one fourth of the population of Europe, are said to have perished. It was a veritable Black Death, for the degradation and misery which Europe suffered during the Middle Ages and from which it very slowly recovered, was largely due to this pestilential disease. Towns were left empty and all trade was at an end. All feared "the pestilence that walketh in darkness," none knowing when their turn would come to be smitten.

Venice at this time was the gateway through which the commerce of the East passed into Europe. Goods were brought by caravans to the shores of the Mediterranean or the Black Sea and from these points carried by ships to Italy to be distributed over Europe. On their way to the Mediterranean the caravans passed through the endemic centers of plague in Asia Minor, bringing the disease to all regions through which they passed.

The close parallelism between commercial routes and the spread of



FIG. 2. ORIGIN OF FIRST EPIDEMIC OF BUBONIC PLAGUE IN PELUSIUM, EGYPT, 542 A.D. (indicated by dot).

plague is illustrated by the fact that with the discovery of a new route to India by way of Cape of Good Hope the plague almost entirely disappeared from Europe. Just as a single rock may alter the course of a stream, so the discovery of this new route brought about the abandonment of the Mediterranean as a highway of commerce in favor of the water route by way of the Cape. As a result the seaports of northern Europe came into prominence as commercial centers whose connections with the East by way of the sea enabled them to avoid the old endemic centers of Asia Minor, and from this time on plague gradually disappeared from Europe.

The present epidemic, the third in the world's history, had its origin in the town of Junnan Fu in China in 1871. The disease spread to neighboring towns and reached Hongkong in 1894. From this point it traveled to India where it raged unchecked for more than ten years, carrying off 6,000,000 of the natives. Since its appearance in India in 1894, the plague has visited many of the larger seaports all over the world, the infection coming either from China or from India. In nearly every case the disease made its first appearance at a seaport, but in some cases, as at Johannesburg and Mecca, it was carried into the



FIG. 3. PROGRESS OF FIRST EPIDEMIC OF BUBONIC PLAGUE 544-570 A.D. (indicated by heavy shading).

interior by the hordes of gold seekers and pilgrims who flocked thither from infected areas.

Very few people realize that at the present time we are in the midst of a potentially serious pandemic and that only the constant vigilance of our authorities enables us to avert such epidemics as culminated in the Black Death of the fourteenth century. Beside the severe outbreaks in Manchuria and India, the present plague has manifested its presence in all of the principal Chinese seaports, traveling from its source of origin east to Melbourne, Brisbane and other Australian cities, south to Portugal and Scotland, and around the world to Brazil, Porto Rico and California. Yet in spite of this almost universal diffusion, our knowledge of the rat as the carrier of the germ of plague has made it possible to confine the disease within narrow limits everywhere outside of Asia.

From time immemorial various explanations have been given of the causes of plague. From Biblical records, we learn that this pestilence was considered a judgment which God in his wrath inflicts upon man to punish him for his sins. The connection between human plague and the disease among rodents was long ago suspected, for mention is made in the Book of Samuel of the fact that in order to stay the progress



FIG. 4. MAXIMUM EXTENSION OF FIRST EPIDEMIC OF BUBONIC PLAGUE 570-650 A.D. The disease spread to all the then known parts of the world (indicated by heavy shading).

of the disease offerings were made of golden images of mice and of the tumors characteristic of plague. Others have looked upon the disease as an emanation from contaminated soil, while others have blamed the air as the carrier of this pestilence.

Plague as we know it to-day is primarily a disease of the rat and only secondarily a disease of man. The germs of the disease are transmitted from rat to rat and from rat to man through the agency of the flea. When a rat dies of plague the fleas leave the dead animal and by preference attach themselves to other rats, attacking human beings only if there are no other rats to be found. The fleas which carry the germ of bubonic plague fasten themselves upon rats, from the blood of which they take their nourishment. Thus Jonathan Swift's jest about the endless chain of parasites which prey one upon the other, finds here an apt illustration of its scientific truth.

Modern sanitary science recognizes two steps in the solution of the plague problem—first the keeping out of plague cases by strict quarantine measures and second the elimination of the carrier, namely, the rat.

The latter solution is not as easy as one might at first suppose, for even on the best guarded ships and trains rats somehow find their way



FIG. 5. ORIGIN OF SECOND EPIDEMIC OF BUBONIC PLAGUE IN MESOPOTAMIA IN 1050 (indicated by dot).

aboard and take passage as stowaways. Having reached a new port they commence breeding very rapidly and before long have established a firm footing in their new environment. If we could successfully control the peregrinations of the rat the spread of plague would be easily checked, but this being impossible we must wage a war of extermination against him. This may be done either by killing the rats or by destroying their breeding places. The common methods of exterminating these rodents are by trapping, by poisoning, and by utilizing the rats' natural enemies. Traps and poisons have been used with some measure of success, but the rat by his constant association with man has become extremely wary. Rats have been known to enter traps, stand upon the pan with their hind legs, eat the bait and then carefully turn around and back out. They will eat the bread on which poison is spread so carefully that practically all the bread will be eaten while the poison will be left behind. The rats' natural enemies—the cat, dog, weasel and skunk—when given a fair chance will quickly drive him out. The war on rats carried on at San Francisco in 1907, at the time of the appearance of plague in that city, proved the great value of cats and dogs, and to-day San Francisco has a law requiring all structures of



FIG. 6. PROGRESS OF SECOND EPIDEMIC OF BUBONIC PLAGUE 1100-1200. This time the disease spread to the East as trade routes became extended.

800 square feet or less, within certain districts, to be raised high enough above the ground to allow these animals free access to the under side of the building.

Such methods will remove a considerable proportion of the rats, but it is only by prevention of their further breeding that we may hope satisfactorily to control their numbers. The rat requires two conditions for life—plentiful food and a place for nesting. Eliminate either of these and the problem of extermination is solved. To prevent the rat from getting sustenance all places where food-stuffs are stored, such as packing houses, bakeries, groceries, warehouses, grain sheds, docks and wharves, should be either rat proofed or should contain rat-proof receptacles for the food. Particular attention should also be paid to the proper disposition of garbage. To prevent the rat from entering buildings and nesting among the beams underneath the floor, the latter as well as the foundation walls should be concreted; and all openings in the basement screened.

The rats which are most dangerous are of course those brought from plague-ridden countries. To prevent such rats from landing recourse is had to the fumigation of ships and to the placing of rat guards—



FIG. 7. MAXIMUM EXTENSION OF SECOND EPIDEMIC OF BUBONIC PLAGUE, 1200-1450. The close parallelism between trade routes and the spread of the disease is indicated by comparing with Fig. 1.

which are nothing more than circular sheets of metal about two feet in diameter fastened in a vertical position on the ship's mooring lines. By preventing the plague rat from taking passage and from landing we can control the diffusion of plague to other ports; for we know that where trade will go there rats will go and where rats will go there plague will go. Our slogan should therefore be "No rats, no plague."

The other solution of the plague problem which consists in the quarantining of all cases of this disease, derives its name from the practise of the Venetians during the Middle Ages requiring the detention for forty days of all persons well or sick coming from an infected port. To-day, however, with our increased knowledge of sanitary science, preventive measures have become more efficient and less irksome. Ships coming from infected ports are detained for but a day, during which time the infected passengers are isolated, and the vessel fumigated. Isolation of individuals takes the place of quarantine against nations.

The plague very recently discovered at New Orleans would have brought consternation a decade ago, but to-day with the efficient protection of our ports no fear is entertained. Our knowledge of the rat as the carrier of the germ of plague has made it possible to keep this



FIG. 8. ORIGIN OF THIRD EPIDEMIC OF BUBONIC PLAGUE IN JUNNAN FU, CHINA, 1871 (indicated by dot).

disease from spreading, to any considerable extent, anywhere outside of Asia. By enforcing quarantine laws, by disinfecting all ships suspected of harboring infected rats, by preventing the rat from landing, and by the comparative freedom of civilized cities from vermin, we have been able to keep plague from extending beyond the ports at which it has sporadically appeared. It is due to a thorough knowledge of these facts and to the careful sanitary precautions based on this knowledge, that we are not at present suffering from a Black Death similar to the one that ravaged and devastated Europe and Asia in the fourteenth century.

Another of the most dreadful diseases of medieval times is Asiatic cholera. Although this disease was described as early as the fourth century, yet no record appears of its occurrence in epidemic form until the sixteenth century. During the sixteenth, seventeenth and eighteenth centuries cholera was epidemic at various times in India. The disease is indigenous to that country and has been disseminated from India to all quarters of the globe. It is one of the most serious of scourges of unhappy India, the average annual mortality from cholera for the years 1898 to 1907 in India being 366,378.



FIG. 9. PROGRESS OF THIRD EPIDEMIC OF BUBONIC PLAGUE, 1874-1894.

With the increase of commercial intercourse between nations in the nineteenth century, cholera began to spread rapidly and usually, as in the case of plague, along the routes of trade and travel. It was not until 1817 that European physicians were attracted to the study of the disease by an outbreak of a violent epidemic at Jessore in Bengal. This epidemic extended westward from India along two routes—(1) by sea to the shores of the Red Sea, Egypt and the Mediterranean; (2) by land to northern India and Afghanistan, thence to Persia and Central Asia and so to Russia. The disease ravaged the northern and central parts of Europe, spread to England and subsequently appeared in France, Spain and Italy. Then crossing the Atlantic it made its appearance in North and Central America.

Four serious epidemics or pandemics of cholera have occurred, one from 1817-1823, another from 1826-1837, a third from 1846-1862, and a fourth from 1864-1875. In 1832 the disease appeared in New York and extended as far west as the military posts of the upper Mississippi. Later in 1848 it entered the United States through New Orleans, passed up the Mississippi and was carried across the continent by the searchers for gold on the way to California. Immigrant ships brought cholera to our shores again in 1857 and in 1892 and in the latter year only

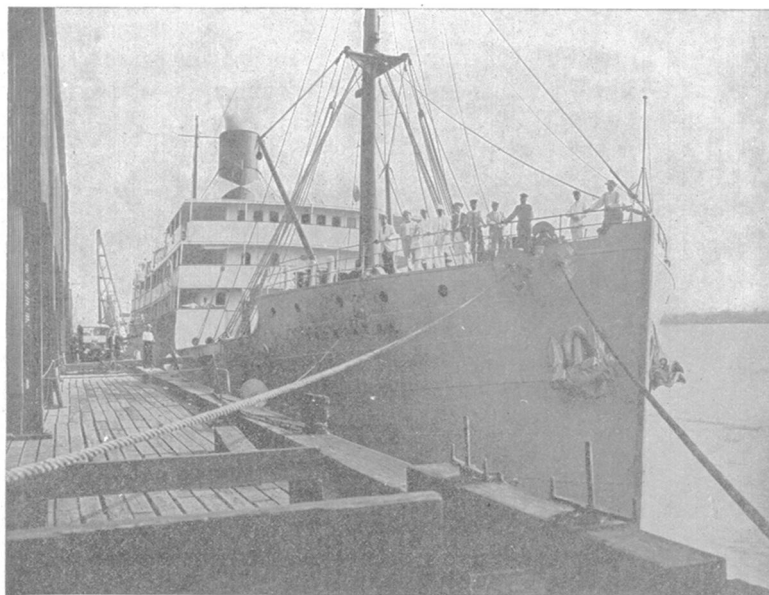


FIG. 10. MAXIMUM EXTENSION OF THIRD EPIDEMIC OF BUBONIC PLAGUE, 1894. This time the spread of the disease is limited to Asia and occasionally to a seaport.

aggressive measures at New York prevented its spread to other points. The fear of cholera was the most successful lobbyist in favor of the creation of the New York city board of health during the epidemic of 1865-1866, and without whose aid the board would scarcely have succeeded in obtaining the needed powers and the required funds for efficient health measures.

While the home of cholera is in the tropics, there is scarcely a country in the world that has not been visited at one time or another by the ravages of this scourge. To-day, however, the disease is largely limited to tropical countries where insanitary conditions still exist.

Like bubonic plague, cholera is spread by man from place to place and this follows the lines of trade and travel. Pilgrimages and fairs are a great factor in the dissemination of the disease, favored by the overcrowding and insanitary conditions usually existing at such gatherings. The dispersal of such gatherings then disseminates the disease over wide areas. One of the most important of these recurrent festivals is held at Jaganath temple at Puri in the province of Bengal. Upwards of 100,000 pilgrims gather at this place during July when the principal festival is held. Endemic cholera is rarely absent in Puri and out-



Courtesy of Louisiana State Board of Health.

FIG. 11. SAFEGUARDING A PIER AGAINST RATS. By means of the rat guards on the hawsers and by fenders, rats are prevented from landing.

breaks almost invariably occur at the time of these gatherings—in 1899, 1,216 cases with 1,020 deaths occurred at the July festival in Puri alone.

Cholera, however, spreads along avenues not common to plague. One of the most important of the vehicles of this disease is water. Numberless epidemics have been traced to the pollution of a water supply by a cholera patient. A notable classic example is the Hamburg epidemic of 1892. Cholera was brought to Hamburg by immigrants either from Russia or France. The waters of the Elbe River receiving the wastes of the city were infected with the discharges of the cholera patients, and this water was used by the inhabitants without previous purification. The water supply of Altona adjoining Hamburg was taken from the same river, but first subjected to sand filtration. An outbreak of cholera ensued in Hamburg with 16,957 cases and 8,606 deaths, while 516 cases and 316 deaths occurred in Altona, most of the cases occurring in Altona being traced directly to infection in Hamburg.

Reports from European battlefields inform us of the presence of cholera in Austria. This scourge has been responsible for deaths without number in the wars of the past, for war, famine and pestilence go hand in hand. No army can be considered safe if once it should appear in the theater of operations unless the most stringent precautions against its extension are taken.

In the Crimean war during the months of July and August of 1853, cholera lost to the French army before a shot had been fired as many men as were killed by the enemy during the entire campaign and siege. The number of cases totalled 12,258 and deaths 6,013. The British in this war lost 11,097 men from disease and of this number one fourth died of cholera.

During the war between Austria and Prussia in 1866, the latter country lost more men from cholera than from the casualties of battle.

In our own Civil War upwards of 3,400 cases and 1,500 deaths resulted from the ravages of cholera. This scourge almost destroyed an entire body of recruits brought from New York.

During the war between China and Japan in 1894-1895, cholera claimed 9,658 cases with 5,991 deaths, out of a total of 15,860 deaths from disease, from a mean strength of 227,600.

To-day we know that disease germs are stronger and more deadly than bullets, so that the soldier is sent forth prepared to meet cholera or other scourges that attack men in the field. The soldier is protected against typhoid and cholera by vaccination against these diseases, by attention to the sanitary conditions of the camp, by sterilizing the water supply, by protecting food from flies, by caring for the wastes and by isolation of cases of such communicable diseases. That such precautions can be maintained under the stress of a great war has already been demonstrated.

It is certain, however, that in times of peace cholera, like plague, has no longer any terrors for modern civilization. In the summer of 1911, ship after ship came into the harbor of New York from cholera-infected ports. They were detained for no long period of quarantine; but in 24 to 48 hours every passenger was subject to examination and the carriers of the deadly "comma bacillus" were picked out and isolated. The examination of 26,930 persons at the port of New York revealed 27 such carriers. The rest of the passengers were sent on their way, and the pestilence which used to pass in great waves from continent to continent found an impassable barrier placed in its path by the culture tube and the microscope of the bacteriologist.